CLAIMS

What is claimed is:

1. A system for cooling a motor, comprising:

a temperature adjusting device which adjusts temperature of a heat transfer fluid to approximately boiling temperature;

a pressure device which adjusts pressure of the heat transfer fluid to maintain the boiling temperature of the heat transfer fluid at a predetermined level such that the boiling temperature remains substantially constant at the predetermined pressure as heat is absorbed by the heat transfer fluid generated by the motor; and

a pump which pumps the heat transfer fluid through the temperature adjusting device, the pressure device and the motor.

2. The system of claim 1, wherein the pressure device is a fixed aperture device.

3. The system of claim 2, wherein the fixed aperture device is a one of a venturi and orifice.

4. The system of claim 2, further comprising an atmospheric vent.

5. The system of claim 1, wherein the pressure device is an adjustable pressure valve.

6. The system of claim 5, wherein the adjustable pressure valve is actively controlled to maintain the predetermined pressure to ensure the heat transfer fluid temperature remains at approximately the boiling temperature as it passes through the motor.

7. The system of claim 5, wherein the adjustable pressure valve is one of a pressure regulator and restrictor both adapted to change the pressure and thereby the

boiling temperature of the heat transfer fluid.

8. The system of claim 1, further comprising a temperature feedback loop which monitors and adjusts the temperature of the heat transfer fluid via the temperature adjusting device such that a $T_{desired}$ temperature is substantially equal to a T_{in} temperature entering the motor.

9. The system of claim 1, further comprising a pressure feedback control device which adjusts the pressure of the heat transfer fluid via the pressure device such that the boiling temperature of the heat transfer fluid is maintained at a $T_{desired}$ temperature.

10. The system of claim 1, further comprising:

a temperature feedback loop which monitors and adjusts the temperature of the heat transfer fluid via the temperature adjusting device such that a $T_{desired}$ temperature is substantially equal to a T_{in} temperature; and

a pressure feedback control device which monitors and adjusts the pressure of the heat transfer fluid via the pressure device such that the boiling temperature of the heat transfer fluid is maintained at a T_{out} temperature which is substantially equal to the $T_{desired}$ temperature.

11. The system of claim 10, further comprising a controller that compares the T_{out} temperature to the $T_{desired}$ temperature and the $T_{desired}$ temperature to the T_{in} temperature to ensure that the temperature of the heat transfer fluid remains approximately constant and boiling of the heat transfer fluid occurs.

12. The system of claim 1, wherein the pump provides an increase in the pressure of the heat transfer fluid and the pressure device provides a pressure drop of the heat transfer fluid prior to entering the motor.

13. The system of claim 1, further comprising an accumulator and attached valve,

where the pressurized heat transfer fluid collects in the accumulator and the attached valve drops the pressure as the heat transfer fluid flows toward the pressure device.

14. The system of claim 1, further comprising a valve used to drop the pressure to atmospheric and a reservoir vented to atmosphere.

15. The system of claim 14, wherein the reservoir includes the temperature adjusting device.

16. The system of claim 1, further comprising a condenser which is downstream from the motor and which is adapted to remove heat generated from the motor from the heat transfer fluid.

17. The system of claim 1, further comprising a valve at an exit side of the motor which drops the pressure of the heat transfer fluid to atmospheric and a vented reservoir provided at atmospheric pressure.

18. The system of claim 1, wherein the heat transfer fluid is a coolant has a boiling temperature at atmospheric pressure above room temperature.

19. The system of claim 1, wherein the heat transfer fluid is a coolant a boiling temperature less than ambient temperature at atmospheric pressure.

20. A system for cooling a linear motor, comprising:

a thermoelectric device adjusting a temperature of a coolant to a boiling temperature of the coolant;

an adjustable pressure regulating device adjusting a pressure of the heat transfer fluid to maintain the boiling temperature at a predetermined level for the coolant; and

a feedback control unit which:

adjusts the temperature of the coolant via the thermoelectric device such that a $T_{desired}$ temperature is substantially equal to a T_{in} temperature; and

adjusts the pressure of the coolant via the adjustable pressure regulating device such that the boiling temperature of the coolant is maintained at a T_{out} temperature which is substantially equal to the $T_{desired}$ temperature,

wherein the adjustable pressure regulating device maintains the boiling temperature of the coolant as heat is absorbed by the coolant generated from the linear motor.

21. The system of claim 20, further comprising an accumulator and attached valve, the accumulator collects the pressurized coolant and attached valve drops the pressure of the coolant.

22. The system of claim 20, further comprising a coarse valve used to drop the pressure of the coolant to atmospheric and a reservoir downstream from the coarse valve vented to atmosphere, where the reservoir is adapted to include the thermoelectric device.

23. The system of claim 20, further comprising a valve downstream from the linear motor which drops the pressure of the coolant back to atmospheric and a vented reservoir.

24. The system of claim 23, wherein the coolant is a fluid that at atmospheric pressure boils below room temperature.

25. The system of claim 20, further comprising a condenser which removes heat from the heated coolant.

26. A method of cooling a motor, comprising the steps of:

adjusting the temperature of a heat transfer fluid to approximately boiling

temperature; and

adjusting a pressure of the heat transfer fluid to maintain the boiling temperature of the heat transfer fluid at a predetermined pressure such that the boiling temperature remains substantially constant as heat is absorbed by the heat transfer fluid generated by the motor.

27. The method of claim 26, further comprising pumping the heat transfer fluid through the motor at the adjusted temperature and predetermined pressure.

28. The method of claim 26, further comprising venting the heat transfer fluid to atmospheric pressure after the pumping step.

29. The method of claim 26, further comprising actively controlling the pressure of the heat transfer fluid to maintain the predetermined pressure to ensure the heat transfer fluid temperature remains at approximately the desired boiling temperature as it passes through the motor.

30. The method of claim 26, further comprising the step of providing a feed back which:

(i) monitors and adjusts the temperature of the heat transfer fluid such that a $T_{desired}$ temperature is substantially equal to a T_{in} temperature entering the motor; and

(ii) monitors and adjusts the pressure of the heat transfer fluid such that the boiling temperature of the heat transfer fluid is maintained at the $T_{desired}$ temperature which is substantially equal to a T_{out} temperature.

31. The method of claim 30, further comprising the step of comparing the T_{out} temperature to the $T_{desired}$ temperature and the $T_{desired}$ temperature to the T_{in} temperature to ensure that the temperature of the heat transfer fluid remains substantially constant and boiling of the heat transfer fluid occurs.

32. An exposure apparatus, comprising:

an illumination system that projects radiant energy through a mask pattern on a reticle R that is supported by and scanned using a wafer positioning stage;

at least one linear motor that positions the wafer positioning stage;

a system for cooling the at least one linear motor, including

a temperature adjusting device adjusting a temperature of a coolant to approximately a boiling temperature prior to flowing through the at least one linear motor; and

a pressure device that adjusts a pressure of the coolant to maintain the boiling temperature of the coolant at a predetermined level prior to flowing through the at least one linear motor to maintain the boiling temperature as heat is absorbed by the coolant from the at least one linear motor.

33. A device manufactured with the exposure apparatus of claim 32.

34. A wafer on which an image has been formed by the exposure apparatus of claim 32.

35. The exposure apparatus of claim 32, further comprising a pump which pumps the coolant through the temperature adjusting device, the pressure device and the at least one linear motor.

36. The exposure apparatus of claim 32, wherein the motor is mounted on a reticle stage

37. The exposure apparatus of claim 32, wherein the motor includes coils having a roughened surface to produce uniform and vigorous boiling.

38. The system of claim 20, wherein the linear motor includes coils having a roughened surface to produce uniform and vigorous boiling.